

much in general I shall hint, that I suppose the *medium* MMM to have less of the transparent undulating subtle matter, and that matter to be less implicated by it, whereas LLL I suppose to contain a greater quantity of the fluid undulating substance, and this to be more implicated with the particles of that *medium*.

But to proceed, the same kind of *obliquity* of the Pulses and Rays will happen also when the refraction is made out of a more easie into a more difficult *mediū*; as by the calculations of GQ & CSR which are refracted from the perpendicular. In both which calculations 'tis *obvious* to observe, that always that part of the Ray towards which the refraction is made has the end of the *orbicular pulse* precedent to that of the other side. And always, the oftner the refraction is made the same way, Or the greater the single refraction is, the more is this unequal progress. So that having found this odd propriety to be an inseparable concomitant of a refracted Ray, not streightned by a contrary refraction, we will next examine the refractions of the Sun-beams, as they are suffer'd onely to pass through a small passage, *obliquely* out of a more difficult, into a more easie *medium*.

Let us suppose therefore ABC in the second Figure to represent a large *Chimical Glass-body* about two foot long, filled with very fair Water as high as AB, and inclin'd in a convenient posture with B towards the Sun: Let us further suppose the top of it to be cover'd with an *opacous* body, all but the hole *ab*, through which the Sun-beams are suffer'd to pass into the Water, and are thereby refracted to *cdef*, against which part, if a Paper be expanded on the outside, there will appear all the colours of the Rain-bow, that is, there will be generated the two principal colours, *Scarlet* and *Blue*, and all the *intermediate* ones which arise from the composition and dilutings of these two, that is, *cd* shall exhibit a *Scarlet*, which toward *d* is diluted into a *Yellow*; this is the refraction of the Ray, *ik*, which comes from the underside of the Sun; and the Ray *ef* shall appear of a deep *Blue*, which is gradually towards *e* diluted into a pale *Watchet-blue*. Between *d* and *e* the two *diluted* colours, *Blue* and *Yellow* are mixt and compounded into a *Green*; and this I imagine to be the reason why *Green* is so acceptable a colour to the eye, and that either of the two extremes are, if intense, rather a little offensive, namely, the being plac'd in the middle between the two extremes, and compounded out of both those, *diluted* also, or somewhat qualifi'd, for the *composition*, arising from the mixture of the two extremes *undiluted*, makes a *Purple*, which though it be a lovely colour, and pretty acceptable to the eye, yet is it nothing comparable to the ravishing pleasure with which a curious and well tempered *Green* affects the eye. If removing the Paper, the eye be plac'd against *cd*, it will perceive the lower side of the Sun (or a Candle at night which is much better, because it offends not the eye, and is more easily manageable) to be of a deep *Red*, and if against *ef* it will perceive the upper part of the luminous body to be of a deep *Blue*; and these colours will appear deeper and deeper, according as the Rays from the luminous body fall more *obliquely* on the surface of the Water, and thereby suffer a greater refraction, and the

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more distinct, the further *cdef* is removed from the trajecting hole.

So that upon the whole, we shall find that the reason of the *Phænomena* seems to depend upon the *obliquity* of the *orbicular pulse*, to the Lines of Radiation, and in particular, that the Ray *cd* which constitutes the *Scarlet* has its inner parts, namely those which are next to the middle of the luminous body, precedent to the outermost which are contiguous to the dark and *unradiating* skie. And that the Ray *ef* which gives a *Blue*, has its outward part, namely, that which is contiguous to the dark skie precedent to the pulse from the innermost, which borders on the bright area of the luminous body.

We may observe further, that the cause of the *diluting* of the colours towards the middle, proceeds partly from the wideness of the hole through which the Rays pass, whereby the Rays from several parts of the luminous body, fall upon many of the same parts between *c* and *f* as is more manifest by the Figure: And partly also from the nature of the refraction it self, for the vividness or strength of the two terminating colours, arising chiefly as we have seen, from the very great difference that is betwixt the outsides of those *oblique undulations* & the dark Rays circumambient, and that disparity betwixt the *approximate* Rays, decaying gradually: the further inward toward the middle of the luminous body they are remov'd, the more must the colour approach to a white or an undisturbed light.

Upon the calculation of the refraction and reflection from a Ball of Water or Glass, we have much the same *Phænomena*, namely, an *obliquity* of the undulation in the same manner as we have found it here. Which, because it is very much to our present purpose, and affords such an *Instancia crucis*, as no one that I know has hitherto taken notice of, I shall further examine. For it does very plainly and positively distinguish, and shew, which of the two *Hypotheses*, either the *Cartesian* or this is to be followed, by affording a generation of all the colors in the Rainbow, where according to the *Cartesian Principles* there should be none at all generated. And secondly, by affording an instance that does more closely confine the cause of these *Phænomena* of colours to this present *Hypothesis*.

And first, for the *Cartesian*, we have this to object against it, That whereas he says (*Meteorum* Cap. 8. Sect. 5.) *Sed judicabam unicam (refractionē scilicet) ad minimū requiri, & quidem talem ut ejus effectus aliā contrariā (refractionē) non destruat: Nam experientia docet si superficies NM & NP (nempe refringentes) Parallelae forent, radios tantundem per alteram iterum erectos quantum per unam frangerentur, nullos colores depicturos*; This Principle of his holds true indeed in a *prisme* where the refracting surfaces are plain, but is contradicted by the Ball or Cylinder, whether of Water or Glass, where the refracting surfaces are *Orbicular* or *Cylindrical*. For if we examine the passage of any *Globule* or Ray of the primary *Iris*, we shall find it to pass out of the Ball or Cylinder again, with the same inclination and refraction that it enter'd in withall, and that that last refraction by means of the *intermediate* reflection shall be the same as if without any reflection at all the Ray had been twice refracted by two *Parallel* surfaces.

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